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AN OCCURRENCE OF LAMELLAR CALCITE (ARGENTINE) IN PENNSYLVANIA

SAMUEL G. GORDON

Academy of Natural Sciences of Philadelphia

WITHIN the past three years a new locality for argentine has become well known to Philadelphia collectors, both for the fine specimens of this mineral, and for the accompanying stilbite, laumontite, and heulandite. The occurrence is mineralogically and geologically quite different from those in Rhode Island and in Massachusetts, as described by Hawkins,¹ Hitchcock,² and Nash.³

The locality is Ward's quarry, on the east side of Crum Creek, about a half mile southeast of Crum Lynne Station, Delaware county.

The rocks of the quarry consist of a granite gneiss, a biotite gneiss, possibly a more basic facies of the former, and pegmatite. The granite gneiss is a light-colored, medium-grained, quartz-feldspar-mica rock, forming the bulk of the material quarried. Closely associated with this is the biotite-gneiss, a coarse-grained, more or less porphyritic rock, of a dark color, composed essentially of biotite, oligoclase, and quartz. Numerous pegmatite dikes cut these rocks, having a general N. W. to S. E. direction, and varying in width from a few inches to 16 feet. The following minerals have been noted in the pegmatites: quartz, microcline (in large pink cleavages), albite (greenish crystals up to one and a half inches), muscovite, biotite, garnet, and tourmaline.

The lamellar calcite (argentine) and the zeolites occur as vein fillings in a series of closely spaced sheeted zones (due to shearing

¹Alfred C. Hawkins, "The Occurrence of Lamellar Calcite in Rhode Island," *This Journal* **1**, 3, 1916.

²Edward Hitchcock, Final Report, Geology of Massachusetts, 562, 1841.

³Alanson Nash, "Notices of the Lead Mines and Veins of Hampshire County Massachusetts," *Am. J. Sci.* [1], **12**, 255-258, 1827.

or faulting movements), striking E.-W. and N. 60° W., and traversing all three types of rock. The argentine is milky-white in color and has a characteristic pearly luster (often termed silvery, whence the name argentine) due to the wavy lamellar structure (see Plate IV); occasionally it grades into normal calcite. Stilbite and laumontite are the most abundant zeolite minerals, the former occurring in yellow radiations up to two inches, and the latter in small white and yellowish radiating crystals. Heulandite crystals up to an inch in diameter have been found in the laumontite. Mesolite in mealy white radiations up to one inch in diameter has also been noted. The minerals were deposited in the following sequence: stilbite and laumontite; heulandite; calcite. No alteration of the wall rock is observable, beyond slight secondary enlargement of the quartz grains into small crystals, and occasional thin films of chlorite and epidote.

Zeolites are by no means rare in such acidic gneisses, and in fact, the frequency of this mode of occurrence leads to the belief that they were produced by meteoric waters, the efficacy of which in extracting calcium, sodium, aluminium, etc., from rocks can not be doubted. Probably the process suggested by Fenner,⁴ selective solution of the anorthite molecule of the oligoclase of the acidic gneiss, has been effective here. The cause of the unusual habit of the calcite can not have been high temperature, for the zeolites which preceded it would have been decomposed had this greatly exceeded 100°, but no conclusive evidence of other possible causes can be obtained at this locality. It may be suggested, however, that the lamellar habit may have been due to the presence of traces of silicates, in this case zeolite material, in the solution. In the occurrence described by Mr. Hawkins perhaps the chlorite played the same rôle. It must be remembered, however, that free silica appears to produce an opposite effect, Mr. Whitlock⁵ having shown that several lines of evidence appear "to connect beyond question the pyramidal habit of calcite with a crystallizing solution saturated or nearly saturated with silica." Additional data upon such questions are greatly needed.

⁴ Clarence N. Fenner, The Watchung basalt and the paragenesis of its zeolites and other secondary minerals, *Ann. N. Y. Acad. Sci.*, **20**, 121, 1910.

⁵ N. Y. State Mus. *Memoir* **13**, 134—135, 1910.

THE MINERALS OF BRINTON'S QUARRY, CHESTER COUNTY, PA.

HUGH E. MCKINSTRY

West Chester, Pa.

BRINTON'S QUARRY is one of the most famous of the mineral localities in the serpentine rocks of southeastern Pennsylvania; it is the type locality for jefferisite, and is noted for the fine crystals of clinochlore that it formerly produced. An account of its present condition and list of minerals complete to date will therefore be of interest to collectors.

The quarry is located in Westtown Township, Chester County, Pa., three miles south of West Chester. It is along the Birmingham road (continuation of South New Street, West Chester) southeast of its crossing with the Street Road. On the ninth-coordinate system the location is West Chester quadrangle 5322.

It is variously referred to in mineralogies as West Chester, Birmingham, Westtown, etc., or merely as Chester County.

HISTORY AND PRESENT CONDITION

The quarry was first opened in 1730¹ and many farmhouses of the region dating before the Revolution are built of its serpentine. In the '70's of the last century, when operations were carried on by Mr. Joseph H. Brinton, the stone was in great demand for building purposes. On account of its softness, sawing machinery was at one time used to cut it into blocks, but by 1880 this had been discarded, and the operation was by hand and horse power.

The quarry afforded stone for four buildings of the University of Pennsylvania, for the Academy of Natural Sciences of Philadelphia (this has since been re-faced), for the court house at Wilmington, Del., for the buildings of the West Chester State Normal School, and for about twenty churches in Philadelphia and Baltimore. Experience has shown, however, that the stone disintegrates rapidly in the sulfuric acid-laden atmosphere of cities, and it is no longer used.

The appearance of the quarry at present is not over-encouraging to collectors. Really active work has not been done for a

¹Second Geol. Surv. Pa. Rept. C4, 63, 1883.

score of years, two of the three quarry pits being filled with water of uncertain depth—from thirty to sixty feet (depending upon the imagination of your informant), and the chrome-green water together with the rugged grayish green cliffs present a scene which a fertile fancy might convert into a Swiss mountain lake.

In the largest quarry hole (the central pit), intermittent operations are carried on above the level of the water by a local contractor, occasionally exposing a vein of jefferisite, and veins of magnesite with magnetite. The minerals now to be found occur here, or in weathered condition on the dumps and old workings. Operations just beginning in the western quarry hole have as yet brought to light nothing of interest.

GEOLOGY

Serpentine.—The main rock of the quarry is compact green serpentine, which occurs in a lenticular outcrop about a quarter of a mile in length. It is in the same general belt as the exposures at Edgemont, Delaware County; and Street Road and Unionville, Chester County. The surrounding rock is Wissahickon mica gneiss, but $\frac{1}{4}$ mile to the north is an area of highly hornblendic gabbro, and the same distance to the south are exposed dikes of pegmatite. The serpentine contains veins of magnesite and magnetite, and smaller seams of deweylite, talc, and other alteration products.

Granite.—Cutting the serpentine is a dike of white granite several feet wide. It is composed of quartz, feldspar, and muscovite, with accessory tourmaline. This dike is exposed on the ridge between the main quarry and the eastern pit.

Pegmatite.—The serpentine is also cut by irregular pegmatite dikes, some composed of striated feldspar with pearly muscovite and little if any quartz—others of partially kaolinized feldspar and jefferisite, and still others of pure jefferisite.

MINERALOGY

The minerals of this locality have been described in more or less detail in the following articles:

Benge, Elmer, and Wherry, Edgar T. Directory of the mineral localities in and around Philadelphia. *Mineral Collector*, 15, 1908, p. 54.

- Blake, W. P. Optical and blow-pipe examination of the supposed chlorite of Chester Co., Pa. *Am. J. Sci.*, **12**, 1851, p. 339.
- Mineralogical Notices, *ibid.*, **13**, 1852, p. 116.
- Brush, G. J. Ninth Supplement to Dana's Mineralogy. *Am. J. Sci.*, **31**, 1861, p. 369.
- Mineralogical Notices, *ibid.*, **41**, 1866, p. 248.
- See also Smith and Brush.
- Craw, W. J. On the clinocllore of Chester Co., Pa. *Am. J. Sci.*, **13**, 1852, p. 222.
- Dana, James D. Mineralogical Notices. *Am. J. Sci.*, **15**, 1853, p. 436.
- System of Mineralogy, Fifth Edition, 1868: Sixth Edition, 1892.
- Genth, F. A. Mineralogy of Pennsylvania, Report B, Second Geol. Survey, Pa. 1875.
- Jefferis, William W. See Rand, Jefferis and Cardeza.
- Lea, Isaac. An account of the minerals at present known to exist in the vicinity of Philadelphia. *Jour. Acad. Nat. Sci.*, Philadelphia, **1**, 1818, p. 462.
- Rand, T. D., Jefferis, W. W., and Cardeza, J. T. M. Mineral localities of Philadelphia and vicinity. *Proc. Acad. Nat. Sci.*, Philadelphia, 1892, p. 174.
- Smith, J. Lawrence, and Brush, Geo. J. Reëxamination of American minerals. *Am. J. Sci.*, **15**, 1853, p. 215.
- Wherry, Edgar T. See Bengé and Wherry.

The minerals known to have been found in these quarries, arranged alfabetically, with references, are:

Actinolite. Dana, 1868, p. 778.

In fibers associated with chrysotile, especially in serpentine adjoining pegmatite.

Apatite.

A hexagonal crystal of green apatite was found by Mr. Biernbaum in 1913 in the vein of jefferisite on the west side of the main quarry.

Aragonite. Smith and Brush, 1853, p. 215.

Radiating white crystals on serpentine. Now found only on the dumps.

Asbestos (See chrysotile).

Beryl. Genth, 1875, p. 71.

Mentioned in the Mineralogy of Pennsylvania as occurring in hexagonal crystals in the granite dike.

Bronzite (See enstatite).

Chromite. Benge and Wherry, 1908, p. 54.

Nodules of granular chromite occur; crystals reported.

Chrysotile (asbestos). Dana, 1868, p. 778.

Soft fibers $\frac{3}{4}$ in. to 1 in. long associated with magnetite and deweylite. Masses of fibers 5 in. in diameter. West wall of main quarry, south of pegmatite dike.

Clinochlore. Blake, 1851, p. 339; 1852, p. 116; Craw, 1852, p. 222; Dana, 1853, p. 436.

Plates six inches or more in diameter have been found, as well as monoclinic, pseudohexagonal, crystals. At present plates two to three inches in diameter and occasionally small crystals are obtainable.

Deweylite. Jefferis, 1892, p. 189.

Masses of yellow deweylite with dendritic markings, admixed with talc, on west side of main quarry. Common on slickensided faces and lining joint planes. Occurs in veins in magnesite.

Enstatite, var. bronzite.

Large metallic-looking grains in serpentine, particularly in the western pit.

Ilmenite. Dana, 1868, p. 778.

Occurs in large lumps imbedded in serpentine.

Jefferisite. Brush, 1861, p. 369; 1866, p. 248.

Named after its discoverer, the late William W. Jefferis, of West Chester, who found it at this locality. It was determined to be a new species by Brush.¹

Occurs in veins, either alone or with triclinic feldspar as an altered pegmatite, also in fine flakes between the serpentine and the granite dike. The best vein is exposed on the west side of the main quarry. It is one to three feet thick, and composed of pure jefferisite. Most of the flakes are small, but plates are found up to 5 in. in diameter, and frequently six-sided crystals.

Limonite.

Occurs with drusy quartz in the zone of weathering.

¹ This mineral had been previously known as phlogopite to collectors.

Magnesite. Blake, 1851, p. 339.

White compact magnesite is found in numerous veins in the serpentine. One about two inches wide is exposed near the diving board at the northwest corner of the main quarry. It is massive, and in some places traversed by a network of green deweylite veins. Specimens four inches or more across may be obtained.

Magnetite. Blake, 1851, p. 238.

In veins in serpentine, also in grains in the massive rock. A vein from 1 in. to 2 in. wide is visible near the magnesite vein just mentioned. It affords large lumps of hard, lustrous black magnetite. Like the magnesite, it is cut by small deweylite veins.

Muscovite. Dana, 1868, p. 778.

Pearly plates with oligoclase in pegmatite on west wall of main quarry.

Oligoclase. Jefferis, 1892, p. 189.

In pegmatite dike on west side of main quarry. Glassy cleavages showing striation.

Quartz (drusy). Genth, 1875, p. 57.

In veins near surface, and in honeycomb quartz. Fragments loose on the ground at top wall of main quarry. This mineral is a characteristic product of the weathering of serpentine.

Quartz (var. amethyst). Dana, 1892, p. 1068.

Has been reported, but it is doubtful if amethyst occurs in the serpentine; probably came from the adjoining Wissahickon gneiss.

Ripidolite (See Clinocllore).

Sepiolite. Bengé and Wherry, 1908, p. 54.

Has been reported by Philadelphia collectors.

Serpentine. Lea, 1818, p. 478.

The main rock of the quarry; specimens of translucent material approaching williamsite are often found. Also pieces containing bronzite grains, veins of chrysotile, deweylite and magnesite, which make handsome polished specimens.

Talc. Dana, 1868, p. 778.

Green foliated talc occurs in the serpentine in flakes up to an inch in diameter. Also occurs as steatite, especially near pegmatite dikes.

Tourmaline. Jefferis, 1892, p. 189.

Occurs in aggregations of crystals in pegmatite, especially near the jefferisite vein on the west side of the main quarry. Lumps 2 in. in diameter of aggregated crystals.

The paragenesis of the minerals is summed up in the following table:

1. Magnesian igneous rocks.

- (a) Primary: bronzite, magnetite, chromite, ilmenite.
- (b) Metamorphosed: actinolite, serpentine, chrysotile, deweylite, talc, clinocllore (magnetite).
- (c) Weathered: quartz (drusy), limonite, magnesite, aragonite.

2. Granite and granitic pegmatite.

- (a) Primary: oligoclase, muscovite, beryl, tourmaline, apatite.
- (c) Weathered: jefferisite.

The geologic history of the locality may accordingly be interpreted to have been: A magma high in magnesium but low in silicon intruded into the Wissahickon gneiss of this region, solidifying as a peridotite, composed of bronzite, olivine, and the accessory minerals magnetite, chromite and ilmenite (1(a)). At a later period a granitic magma solidified in the vicinity—probably at some depth below the peridotite, as no large body of granitic rock is now exposed nearby—giving off small dikes of granite and pegmatite, as well as considerable quantities of heated solutions. Acting on the minerals of the peridotite, these produced the minerals of 1(b); the olivine being completely, and the bronzite partly, converted to serpentine, while locally, because of unusual features of composition, the other minerals of this group developed, in relatively small amounts. Subsequently erosion of the region brought the serpentine mass to the surface of the earth, and rain water acted upon it, producing the minerals of 1(c). Simultaneously rock 2 was subjected to the action of the weather and from biotite originally present in it the mineral jefferisite developed.

AN AMERICAN OCCURRENCE OF MILOSCHITE¹

EDGAR T. WHERRY AND GLENN V. BROWN

U. S. National Museum and Bucknell University

Introduction.—An earthy blue mineral resembling chrysocola but stated to contain no copper was recently submitted to the U. S. National Museum by Mr. G. L. Sheldon of Ely, Nevada.² The locality was given as 6 miles north of Ely, and the occurrence as in a sort of vein, between walls of gossan. Preliminary examination confirmed the absence of copper, and showed that the color was due to the presence of chromium, and as the material did not correspond with any numbered species in Dana's System of Mineralogy, it seemed worthy of further investigation. A sample was accordingly submitted by the Museum to Professor Brown, who has contributed the analytical data here given. The mineral proves to agree with the hitherto imperfectly known miloschite, which is here rescued from oblivion and shown to deserve recognition as a definite mineral species.

History of the mineral miloschite.—This substance appears to have been first mentioned in print by Breithaupt in 1838,³ its properties being described, and the name *serbian*, from the country where it was found (Serbia or Servia), being given to it, altho it was noted that the discoverer of the mineral, von Herder, had named it *miloschin*. Kersten,⁴ who made the first analysis of the mineral, used the latter name. Losanitsch⁵ and Groth⁶ spelled this *milosin*, but the original orthography was *miloschin*, and Doelter⁷ used this form. The exact English equivalent of this name would be *miloschine*, but in accordance with the principle of using the standard termination where in any way possible, Dana⁸ changed the name to *miloschite*, which is here adopted. It may be pronounced ml' ō schīte.

¹ Published by permission of the Secretary of the Smithsonian Institution.

² U. S. N. M. Cat. No. 92939.

³ *J. prakt. Chem.* **15**, 327, 1838.

⁴ *Ann. Phys. Chem.* **47**, 485, 1839.

⁵ *Chem. News* **69**, 243, 1894.

⁶ *Tab. Uebers. Min.*, ed. 4, 138, 1898.

⁷ *Handb. Min. Chem.* **2**(7), 161, 1915.

⁸ *Syst. Min.*, ed. 6, 697, 1892.

The early descriptions and analyses of miloschite not being entirely concordant, the material was reinvestigated by Losanitsch⁹ and shown to consist of a blue crystalline constituent low in chromium, the true miloschite, admixed with a variable amount of a green amorphous substance containing a somewhat larger percentage of this element, for which Losanitsch proposed the name *alexandrolite*. But neither Dana, Groth, nor Doelter have classed miloschite as a definite mineral.

The published descriptions of miloschite appeared to fit the mineral from Nevada, but it seemed desirable to compare specimens of the two directly. The Serbian miloschite in the Museum collection being of doubtful authenticity, a specimen was borrowed from Col. Washington A. Roebling, of Trenton, N. J., whose collection includes so many rare minerals; our warmest thanks are herewith extended to Colonel Roebling for his kindness in lending us this material. There seemed every reason to regard this specimen as authentic, for it had been obtained from Bertrand over 40 years previously, and agreed closely with the descriptions. It proved to be essentially identical with the Nevada material.

Formal description.—

MILOSCHITE

Named after Prince Milosch of Serbia: von Herder, 1838.
 $H_4M'''_2Si_2O_9$, with $M''' = Al, Cr, (and Fe)$ MONOCLINIC.

PHYSICAL PROPERTIES

Color pale greenish blue; Ridgway's 43d, calamine-blue (47% green, 30% blue, and 23% white).

Luster waxy to dull.

Translucent.

Hardness $2\frac{1}{2}$.

Specific gravity $2.1 +$

Under the microscope seen to consist of aggregates of very minute crystalline grains, with a small amount of amorphous material; color bluish green; pleochroism none; indices of refraction α and $\beta = 1.552$, $\gamma = 1.559$ (all $\pm .003$); biaxial, with axial angle about 90° ; and showing inclined extinction.

CRYSTALLOGRAPHIC PROPERTIES

System, monoclinic.

Class and axial ratios indeterminate.

Habit nearly equidimensional, to tabular.

Cleavage: traces in one direction (under microscope).

Optical orientation: indeterminate.

⁹ *Loc. cit.* (note 5).

CHEMICAL PROPERTIES

Qualitative tests:

Before the blowpipe infusible, becoming brownish; gives reactions for Cr and Si.

In the closed tube at high temperature yields H_2O .

In HCl almost insoluble, altho a little Al, Fe and Cr are extracted.

After fusion with Na_2CO_3 yields reactions for Cr, Al, Fe, and Si.

Composition: discussed below.

Methods of analysis (by Glenn V. Brown).—Material for study was obtained by crushing the mineral fragments to coarse powder and removing all pieces showing any traces of rust stains or variations in color, the resulting sample being uniformly greenish-blue. This was finely powdered in an agate mortar. As the mineral proved to be only slowly and partially soluble in hydrochloric acid, decomposition was effected by fusion with sodium carbonate, Hillebrand's "Analysis of silicate and carbonate rocks" being followed thruout. All precipitations were repeated when possible.

Water was determined by heating the mineral to 300° in a stream of dry air and collecting and weighing in a calcium chloride tube. Chromium oxide was determined volumetrically, colorimetrically, and gravimetrically, the results being respectively 4.11, 3.80, and 3.64, averaging 3.85%. The colorimetric method is undoubtedly the most accurate, and as the result by it closely approximates the average by all three methods, this average is given as the percentage of chromium oxide present. In one sample iron oxide was determined volumetrically, in the other gravimetrically.

As certain portions of the mineral showed slight rust stains it was thought possible that the iron oxide content was due to invisible material of this nature, and an effort was made to extract any iron rust present by means of hydrochloric acid of various dilutions. It was found, however, that the mineral is partially decomposed even by dilute acids, aluminium and chromium entering the solution as well as iron, so that no conclusive evidence of this could be obtained. In any case the amount of iron oxide is so small that no essential difference in the formula of the mineral would result from considering it an impurity instead of as isomorphously replacing the other sesquioxides, as is done here.

Alkalies were determined by the J. Lawrence Smith method, and sodium proved not to be present in weighable amount.

The other elements were determined by standard methods, as outlined by Hillebrand, using all known precautions; and the absence of other constituents than those given was proved by systematic qualitative analysis. The following results were obtained:

TABLE I. ANALYSES OF MILOSCHITE.

	1	2	3	4	5	6
H ₂ O(105°).....	3.3	3.64	3.44	—	—	—
H ₂ O(300°).....	14.1	13.17	13.37	13.85	13.7	13.76
Al ₂ O ₃	33.5	34.35	34.46	35.89	35.6	30.18
Cr ₂ O ₃	5.8	3.85	3.85	4.01	3.9	9.75
Fe ₂ O ₃	0.9	0.94	0.77	0.89	1.0	0.91
CaO.....	—	0.38	0.36	—	—	—
MgO.....	—	0.08	0.15	—	—	tr.
K ₂ O.....	—	0.28	0.28	—	—	tr.
SiO ₂	43.0	43.40	43.54	45.36	45.8	46.37
	100.6	100.09	100.22	100.00	100.0	100.97

1. Preliminary analysis, to determine general character of material, made by several students under the direction of G. V. B.

2 and 3. Analyses by G. V. B.

4. Average of 2 and 3, after removing H₂O(105°), CaO, MgO, and K₂O and recalculating to 100%.

5. Theoretical composition of H₄M₂Si₂O₉ with M=Al:Cr:Fe=45:4:1.

6. Analysis of Serbian miloschite by Losanitsch, added for comparison; over twice as much chromium is present as in the American mineral, but otherwise the compositions of the two are essentially identical.

Discussion of the results.—The ratios shown in these analyses are those of the kaolinite group, of which the general formula is H₄M'''₂Si₂O₉, with M'''=Al, Fe, and Cr. The known members of this group, with certain of their optical properties, are tabulated below; all are probably monoclinic, but as they are mostly microcrystalline, this is not entirely certain.

TABLE II. THE KAOLINITE GROUP.

Name	M'''	Color	Indices of refraction		
			α	β	γ
Kaolinite.....	Al	white	1.561	1.563	1.567
Faratsihite.....	Al+Fe	yellow	—	?	—
Nontronite (Chloropal).....	Fe	green	1.595	1.595	1.620
Miloschite (with 3.85% Cr)...	Al+Cr	blue	1.552	1.552	1.559
Volchonskite (in part).....	Cr	green	—	1.585	—

In this group end-members as well as isomorphous series are given names since these end-members are known in essentially

pure condition. The unusual colors shown by the metals in this mode of combination are noteworthy: ferric iron, the compounds of which are usually yellow, yield a distinct green color in nontronite; while chromic chromium, which usually produces greens, gives in miloschite a "coppery" blue. The indices of refraction of the last mineral are also somewhat abnormal; when a metal of low atomic weight like aluminium is replaced by one of greater weight, like iron or chromium, the index of refraction usually increases; in miloschite, however, the indices are distinctly less than those of kaolinite. This has been kindly confirmed by Dr. E. S. Larsen, Jr., of the U. S. Geological Survey.

Miloschite is regarded as having as much right to be classed as a mineral species as has fuchsite, for the former is a chromiferous kaolinite, just as the latter is a chromiferous muscovite. It seems best to define it as referring to the isomorphous series of aluminium and chromium compounds irrespective of the relative amounts of these elements, just as wolframite is used for an isomorphous series of iron and manganese compounds, in which now one and now the other element is in excess.

Genesis of miloschite.—The Serbian miloschite is a weathering product of a variety of fuchsite which has been given the apparently unnecessary name of avalite. The Nevada mineral has no doubt been produced in a similar manner, for it is closely associated with weathered sulfides, but the nature of the original chromium-bearing substance and accordingly its exact mode of formation are unknown. Dr. A. C. Spencer of the U. S. Geological Survey, who has made a study of the Ely district, informs us¹⁰ that in that general region sericite is often produced by the action of emanations from igneous rocks on limestones, and suggests that the original mineral of this occurrence may have been a chromiferous sericite of like origin. As no igneous rocks are known there more basic than granodiorite, the chromium in this occurrence, as in certain of those in the Alps described by Dr. R. Canaval,¹¹ and Prof. K. A. Redlich¹² is associated with acidic rather than basic rocks, the usual source of this element.

Miloschite may accordingly be classed with the minerals of weathered silicic hydrothermal deposits.

¹⁰ Private communication.

¹¹ *Z. prakt. Geol.* **16**, 482, 1908.

¹² *Z. prakt. Geol.* **19**, 126, 1911; *Centr. Min. Geol.* **1914**, 65.

REVIEWS AND ABSTRACTS

THE COMPOSITION OF NATURAL BORNITE. E. T. ALLEN, of the Geophysical Laboratory. *Am. J. Sci.* **41**, (5), 409-413, 1916.

Previous work on this mineral is reviewed, and it is shown by 6 analyses made on specimens of which the homogeneity was confirmed metallographically that the formula of the mineral is undoubtedly Cu_5FeS_4 and the specific gravity of the purest material 5.06-5.08. E. T. W.

THE GROWTH OF CRYSTALS UNDER EXTERNAL PRESSURE. STEPHEN TABER. *Am. J. Sci.* **41**, (6), 532-556, 1916.

Crystals of copper sulfate, potassium sulfate and alum were grown in crystallizing dishes in desiccators, loading the crystals in many cases with weights. It was found that loaded crystals were able to increase in height only when there were no unloaded crystals or volunteer crystals present in the same dish.

A characteristic feature, shown whenever a measurable lifting of a weight took place, was the development of a terraced cavity or hollow on the under side, and in a few instances on the upper side; careful measurement showing that the distances thru which the weights are lifted are always the same as the depth of the hollows. The cavities are not formed by solution as thought by Bruhns and Mecklenburg, but are due to the downward growth of the outer edge, while at the same time no material is being deposited on the under surface within this edge.

A crystal will grow in a direction in which external forces oppose growth, if the surface on which the forces are acting is in contact with a supersaturated solution. If the crystal of a substance, the solubility of which increases with pressure, is subjected to a greater pressure, an increase of the concentration of the solution is necessary; if the pressure is greater in one direction than in others (as when a weight is placed on a crystal), the surfaces that are under lesser pressure will tend to limit the concentration of the solution and prevent it from becoming supersaturated with respect to the surfaces that are rendered more soluble because of greater pressure,—means for maintaining the supersaturation must then be provided.

Dr. Taber believes that the forces developed during crystal growth have played an exceedingly important part in the formation of many veins, and in other geological phenomena.

S. G. G.

CONTRIBUTIONS TO MINERALOGY AND THE MINERAL SPRINGS OF JAPAN. GEORGE F. KUNZ, of New York. *Science* **43**, 748-750, May 26, 1916.

A review of three publications issued in 1914-1915.

E. T. W.

NOTES ON RARE MINERALS IN MADAGASCAR. T. P. WAITES. *J. Chem. Met. Soc. S. Africa* **16**, 187-189, 1916.

A general description of uranium-bearing minerals found on the island.

E. T. W.

STUDIES IN HYDROTHERMAL ALTERATION. I. THE ACTION OF CERTAIN ALKALINE SOLUTIONS ON FELDSPARS AND HORNBLENDE. E. A. STEPHENSON, of the University of Chicago. *J. Geology* **24**, (2), 180-199, 1916.

Powdered minerals were heated in specially constructed apparatus with water and dilute solutions of sodium carbonate, sodium bicarbonate, potassium fluoride, etc. The feldspars were apparently not attacked by pure water, but at the higher temperatures (up to 280°) were decomposed by alkalies with the separation of silica and crystalline compounds, such as analcite and other zeolites, some not known to exist in nature. Fluorides, borates, sulfides, and aluminates had no marked influence on the reactions. No kaolin forms from alkaline solutions, and it is inferred that it is produced by the action of acid waters on minerals.

E. T. W.

SELENIDE OF SILVER. W. W. BRADLEY. *Mining Sci. Press* **112**, (21), 741, 1916.

A mineral believed to be agüarite is reported from the Delama mine, Owyhee Co., Idaho. It is associated with quartz, pseudomorphous after lamellar calcite.

E. T. W.

THE EMERALD DEPOSITS OF MUZO, COLOMBIA.
JOSEPH E. POGUE, of Northwestern University. *Bull. Am. Inst. Mining Eng.* **1916**, (5), 799-822.

(Abstract reprinted by permission from *Chemical Abstracts*, **10**, 15, 1972, 1916.)

The deposits are described under the headings location, history, general geology, detailed geology, minerals, age, origin, mining methods, production, other deposits, acknowledgements, and selected bibliography. The emeralds are found almost entirely in calcite veins that traverse a black, carbonaceous, rather intensely folded formation consisting of thin-bedded shale and limestone. This emerald-formation lies discordantly on a heavier-bedded, barren formation, and between the two occur either albite rock, soft granular aggregates of calcite, dolomite, and quartz, or aggregates of calcite rhombs in a fine-grained calcareous matrix. Pegmatite dikes occur in the vicinity. It is believed that an intrusive magma gave rise to these pegmatites and also gave off mineralizing solutions which, under pneumatolytic conditions but mostly at temps. below 575°, produced the peculiar rocks observed beneath the emerald formation, and deposited the emerald and associated minerals. It is suggested that the occurrence of the emerald only above the plane of discordance is due to the fact that the gaseous portions of the pneumatolytic emanations, which would naturally ascend, caused the formation of the emerald. The carbon of the emerald formation is also believed to have had some precipitating or reducing action.

E. T. W.

ON HYDROZINCITE. W. E. FORD AND W. M. BRADLEY, of Yale University. *Am. J. Sci.* **42**, (1), 59-62, 1916.

Crystallized hydrozincite has recently been found at Good Springs, Lincoln County, Nevada, lining openings in light brown earthy smithsonite. The crystals are exceedingly thin, tabular, and lath-shaped, sharply pointed, and show a pearly luster. Extinction is parallel to the elongation, the direction of the slower ray; optical character biaxial, and with the optical axial plane parallel to the plates; refractive indices: $\alpha = 1.650$ and $\gamma = 1.740$, both $\pm .0005$.

These characters are essentially identical with those of aurichalcite. Accordingly the formula of hydrozincite should be

$2\text{ZnCO}_3 \cdot 3\text{Zn}(\text{OH})_2$, to correspond to that of aurichalcite, $2(\text{Zn}, \text{Cu})\text{CO}_3 \cdot 3(\text{Zn}, \text{Cu})(\text{OH})_2$. The following analyses were made by Bradley:

GOOD SPRINGS, NEVADA

	Crystals	Crystalline Material	Theory for $2\text{ZnCO}_3 \cdot$ $3\text{Zn}(\text{OH})_2$	Sardinia
ZnO.....	75.58	74.67 ¹	74.14	73.72
CO ₂	(15.78)	(16.41)	16.03	(15.47)
H ₂ O.....	8.64	8.92	9.83	10.81
	100.00	100.00	100.00	100.00

¹ Average of two closely agreeing determinations.

These results agree with those obtained on aurichalcite, so that hydrozincite is evidently the copper-free form of latter.

S. G. G.

DETERMINATION OF MINERALS

Minerals sent postpaid to any of the editors of this magazine will be identified, free of charge, in so far as this is possible with the means at our disposal. In most cases an ounce of material is ample for such determination, but a large enough piece should be sent to show something of the mode of occurrence or of the associated minerals, and the locality should be stated in every case. Only scientific data can be supplied—we will not determine the percentages of gold, tungsten, radium, etc., present, or furnish information concerning the commercial values of ores; for such information assayers or mining engineers must be consulted. Results will be announced on the last page of reading matter in this magazine. Specimens to be returned should be accompanied by return postage.

THE PHILADELPHIA MINERALOGICAL SOCIETY FIELD TRIPS, 1916.

October 22: New Galena, Bucks Co., Pa.

Nov. 30 (Thanksgiving Day): Unionville, Chester Co., Pa.

EXCHANGES OFFERED

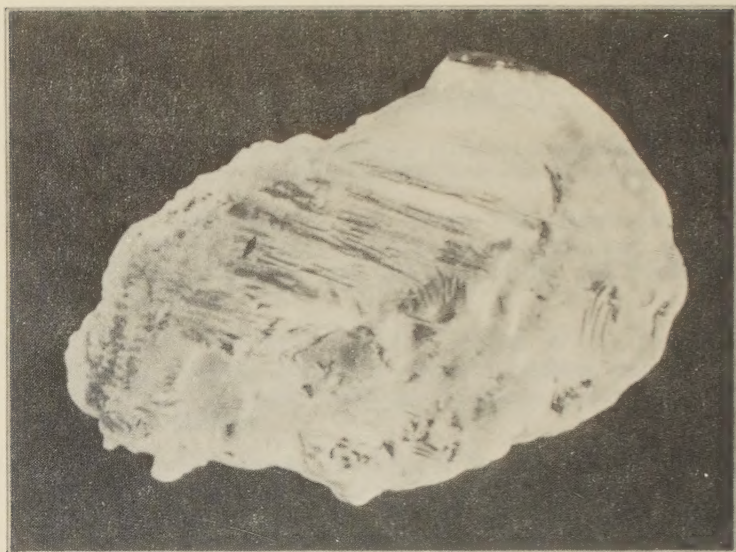
Exchange notices will be printed free of charge to our subscribers in this column. Goods for sale must be offered in the advertising columns.

- W. Scott Lewis, 3493 Eagle St., Los Angeles, Cal. Desert jasper, chalcidony (fine for cutting); rare forms of petrified wood, asphaltum from La Brea fossil beds; shell limestone; biotite, and miscellaneous common minerals.
- Wm. H. Broadwell, 571 Hawthorne Ave., Newark, N. J. New Jersey zeolites (Apophyllite, laumontite, natrolite, pectolite, prehnite, etc.); thaumasite, babingtonite; rhodonite, franklinite, zincite, etc. List sent upon application.
- W. G. Levison, 1435 Pacific St., Brooklyn, N. Y., will exchange fine specimens of New Jersey minerals or some duplicate numbers of the Mineral Collector, for any parts of the Proceedings of the Lyceum of Natural History of N. Y., Series 1 and 2, or any parts of Vols. 1, 2 and 3 of the Annals of the N. Y. Acad. of Sciences.
- B. C. Beegle, 52 Chadwick Ave., Newark, N. J. Apophyllite, thaumasite, prehnite, stilbite, red quartz, heulandite, calcite.
- John Holzman, 182 Ridgewood Ave., Newark, N. J. Heulandite, prehnite, pectolite, red and smoky quartz, fine twin crystals of calcite. Write for list.
- J. P. Wintringham, 153 Henry St., Brooklyn, N. Y. Wanted: triclinic, monoclinic, or orthorhombic crystals for crystallographic measurement or for sections; pericline twins—single or polysynthetic or plagioclases of known composition. Please state what is wanted in return.

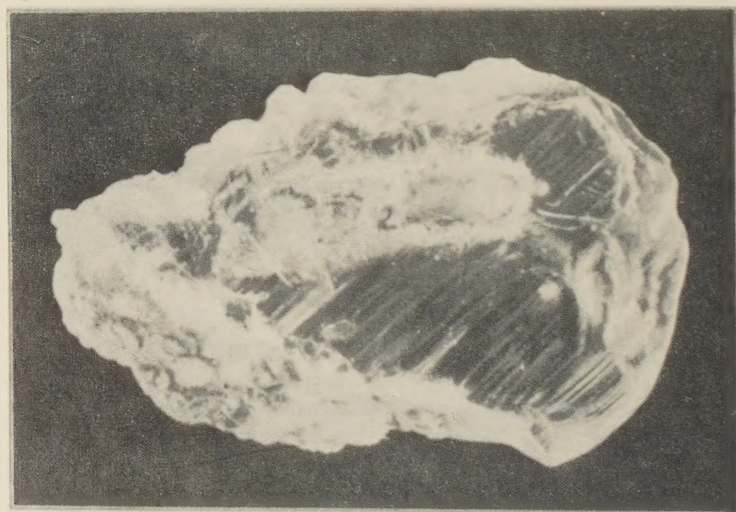
THE MINERAL COLLECTORS ASSOCIATION

A society for those who collect minerals or fossils. Promotes a free and friendly exchange of specimens among its members. Dues: twenty-five cents per year in advance. Official organ, *The Mineral Collectors Bulletin*. For further information, or in making application for membership, address the secretary,

EDMUND EVERETT HOBBS, SR.,
644 Old Niagara Road, Lockport, N. Y.



Front View



Back View

Photographs by Samuel G. Gordon

GYPSUM CRYSTAL, ROUNDED BY WEATHERING, SHOWING A PHANTOM—
A PSEUDOMORPH OF GYPSUM AFTER ANHYDRITE, STUDDED WITH
QUARTZ. WEST PATERSON, N. J. NATURAL SIZE.

PLATE V